

**Dr. Duke's Phytochemical and Ethnobotanical Database**

**Chemicals Found in Avena sativa**

| Activity Count | Chemical  | Plant Part      | Low PPM | High PPM | StdDev             | Reference Citation  |
|----------------|---|-----------------|---------|----------|--------------------|---|
| 0              | 1,3,4-PENTANE-TRICARBOXYLIC-ACID-TRIMETHYL-ESTER  | Pericarp        | --      | 1.3      |                    |   |
| 0              | 1,3,4-PENTANE-TRICARBOXYLIC-ACID-TRIMETHYL-ESTER  | Hull Husk       | 1.3     | 1.3      |                    |   |
| 0              | 1,3-AMINO-PROPYL-PYRROLINIUM                      | Sprout Seedling | --      | --       |                    |   |
| 0              | 2,2,6-TRIMETHYL-CYCLOHEXANONE                     | Seed            | --      | --       |                    |   |
| 0              | 2-CARBOXYARABINITOL                               | Leaf            | --      | 517      | 0.7377260172344527 | Moore, B. D., Isidoro, E., Seemann, J. R. 1993. Distribution of 2-Carboxyarabinitol Among Plants. <i>Phytochemistry</i> 34 3: 703-707. Dept. Biochem. Univ. Nevada Reno 89557, USA. |
| 0              | 2-METHYL-HEPT-2-EN-6-ONE                          | Seed            | --      | --       |                    |   |
| 0              | 26-DESGLUCOAVENACOSIDES                           | Plant           | --      | --       |                    | J.S. Glasby Dict.Pls Containing 2ndary Metabolite. 1991.  |
| 0              | 29-ISOFUCOSTEROL                                  | Seed            | --      | --       |                    |   |
| 0              | 3'-HYDROXYAVENALUMIC-ACID                         | Fruit           | --      | --       |                    |   |
| 0              | 3,4-DIMETHOXY-ACETOPHENONE                        | Petiole         | --      | --       |                    |   |
| 0              | 3,4-DIMETHOXY-ACETOPHENONE                        | Hull Husk       | --      | --       |                    |   |
| 0              | 4,5-DIHYDROXY-7-METHOXY-8-C-GLUCOSYL-O-RHAMNOSIDE | Leaf            | --      | --       |                    |   |

| Activity Count | Chemical                              | Plant Part | Low PPM | High PPM | StdDev | Reference Citation  |
|----------------|---------------------------------------|------------|---------|----------|--------|---|
| 4              | 4-VINYLGUAIACOL                       | Seed       | --      | --       |        |   |
| 0              | 5-DEHYDRO-AVENASTEROL                 | Leaf       | --      | --       |        |   |
| 0              | 5-DEHYDRO-AVENASTEROL                 | Seed       | --      | --       |        |   |
| 0              | 5-HYDROXY-3',5'-DIMETHOXY-GLUCOSIDE   | Leaf       | --      | --       |        |   |
| 0              | 5-HYDROXY-N-HENTRIACONTAN-14,16-DIONE | Seed       | --      | --       |        | Rizk, A.F.M., The Phytochemistry of the Flora of Qatar, Scientific and Applied Research Centre, University of Qatar, Kingprint, Richmond, UK, 1986. |
| 0              | 6-HYDROXY-N-HENTRIACONTAN-14,16-DIONE | Seed       | --      | --       |        | Rizk, A.F.M., The Phytochemistry of the Flora of Qatar, Scientific and Applied Research Centre, University of Qatar, Kingprint, Richmond, UK, 1986. |
| 0              | 7-DEHYDRO-AVENASTEROL                 | Leaf       | --      | --       |        |   |
| 0              | 7-DEHYDRO-AVENASTEROL                 | Seed       | --      | --       |        |   |
| 0              | 7-HYDROXY-N-HENTRIACONTAN-14,16-DIONE | Seed       | --      | --       |        | Rizk, A.F.M., The Phytochemistry of the Flora of Qatar, Scientific and Applied Research Centre, University of Qatar, Kingprint, Richmond, UK, 1986. |
| 0              | 7-METHOXY-VITEXIN-O-RHAMNOSIDE        | Leaf       | --      | --       |        |   |

| Activity Count | Chemical                              | Plant Part      | Low PPM | High PPM | StdDev              | Reference Citation   |
|----------------|---------------------------------------|-----------------|---------|----------|---------------------|--|
| 0              | 7-O-METHOXYVITEXIN-O-RHAMNO-GLUCOSIDE | Sprout Seedling | --      | --       |                     |  |
| 16             | ACETIC-ACID                           | Plant           | --      | --       |                     | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979. |
| 1              | ACONITIC-ACID                         | Plant           | --      | --       |                     | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979. |
| 0              | AEGILOPSIN                            | Hull Husk       | --      | --       |                     | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979. |
| 3              | ALANINE                               | Seed            | 4000    | 4000     | -1.3086899322606569 | Jim Duke's personal files.*  |
| 0              | ALPHA-KETO-GLUTARIC-ACID              | Petiole         | --      | --       |                     |  |
| 0              | ALPHA-KETO-GLUTARIC-ACID              | Hull Husk       | --      | --       |                     |  |
| 32             | ALPHA-TOCOPHEROL                      | Seed            | 4.4     | 10.1     | -0.6988762675539839 | Jim Duke's personal files.*  |
| 5              | ALUMINUM                              | Plant           | --      | --       |                     |  |
| 0              | APIGENIN-6,8-DI-C-GLUCOSIDE           | Leaf            | --      | --       |                     |  |
| 0              | APIGENIN-6-C-GLUCOSIDE                | Leaf            | --      | --       |                     |  |
| 0              | APIGENIN-6-C-GLUCOSYL-ARABINOSIDE     | Leaf            | --      | --       |                     |  |

| Activity Count | Chemical                            | Plant Part | Low PPM | High PPM | StdDev              | Reference Citation  |
|----------------|-------------------------------------|------------|---------|----------|---------------------|---|
| 0              | APIGENIN-6-C-GLUCOSYL-O-ARABINOSIDE | Leaf       | --      | --       |                     |   |
| 0              | APIGENIN-8-C-ARABINOSYLHEXOSIDE     | Leaf       | --      | --       |                     | Rizk, A.F.M., The Phytochemistry of the Flora of Qatar, Scientific and Applied Research Centre, University of Qatar, Kingprint, Richmond, UK, 1986. |
| 0              | APIGENIN-8-C-GLUCOSYL-O-RHAMNOSIDE  | Leaf       | --      | --       |                     |   |
| 0              | APIGENIN-8-C-RHAMNOSYLGLUCOSIDE     | Leaf       | --      | --       |                     | Rizk, A.F.M., The Phytochemistry of the Flora of Qatar, Scientific and Applied Research Centre, University of Qatar, Kingprint, Richmond, UK, 1986. |
| 14             | ARGININE                            | Seed       | 3000    | 13000    | -0.492896993165164  | Jim Duke's personal files.*   |
| 112            | ASCORBIC-ACID                       | Plant      | 26      | 120      | -0.5655146584691259 |   |
| 0              | ASH                                 | Plant      | 18040   | 82000    | -0.7048006092883108 |   |
| 0              | ASH                                 | Seed       | 19000   | 96000    | 1.4473321359680458  |   |
| 3              | ASPARTIC-ACID                       | Seed       | 7000    | 7000     | -1.3839193496072566 | Jim Duke's personal files.*   |
| 0              | AVENACIN-A-1                        | Plant      | --      | --       |                     |   |
| 0              | AVENACIN-A-1                        | Root       | --      | --       |                     |   |

| Activity Count | Chemical      | Plant Part | Low PPM | High PPM | StdDev | Reference Citation   |
|----------------|---------------|------------|---------|----------|--------|--|
| 0              | AVENACIN-B-2  | Plant      | --      | --       |        | Jeffery B. Harborne and H. Baxter, eds. 1983. Phytochemical Dictionary. A Handbook of Bioactive Compounds from Plants. Taylor & Frost, London. 791 pp. |
| 0              | AVENACINS     | Root       | --      | --       |        |  |
| 0              | AVENACOSIDE-A | Seed       | --      | --       |        | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979.                             |
| 0              | AVENACOSIDE-A | Shoot      | --      | --       |        | Jeffery B. Harborne and H. Baxter, eds. 1983. Phytochemical Dictionary. A Handbook of Bioactive Compounds from Plants. Taylor & Frost, London. 791 pp. |
| 0              | AVENACOSIDE-B | Seed       | --      | --       |        | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979.                             |

| Activity Count | Chemical         | Plant Part      | Low PPM | High PPM | StdDev | Reference Citation   |
|----------------|------------------|-----------------|---------|----------|--------|--|
| 0              | AVENACOSIDE-B    | Shoot           | --      | --       |        | Jeffery B. Harborne and H. Baxter, eds. 1983. Phytochemical Dictionary. A Handbook of Bioactive Compounds from Plants. Taylor & Frost, London. 791 pp. |
| 2              | AVENACOSIDES     | Plant           | 1000    | 15000    |        |  |
| 0              | AVENALUMIC-ACID  | Fruit           | --      | --       |        |  |
| 0              | AVENALUMIN-I     | Leaf            | --      | --       |        |  |
| 0              | AVENANTHRAMIDE-G | Shoot           | --      | 22.4     |        |  |
| 3              | AVENANTHRAMIDES  | Seed            | --      | --       |        |  |
| 0              | AVENARIN         | Plant           | --      | --       |        | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979.                             |
| 0              | AVENEIN          | Sprout Seedling | --      | --       |        | Wealth of India.   |
| 0              | AVENIC-ACID-A    | Root            | --      | --       |        |  |
| 0              | AVENIC-ACIDS     | Root            | --      | --       |        |  |
| 1              | AVENIN           | Root            | --      | --       |        |  |
| 1              | AVENIN           | Seed            | 11200   | 185600   |        |  |
| 24             | BENZALDEHYDE     | Seed            | --      | --       |        |  |

| Activity Count | Chemical                               | Plant Part | Low PPM | High PPM | StdDev               | Reference Citation  |
|----------------|--|------------|---------|----------|----------------------|---|
| 53             | BETA-CAROTENE                          | Plant      | 16      | 72       | -0.3372351827937805  |   |
| 0              | BETA-CYCLOCITRAL                       | Seed       | --      | --       |                      |   |
| 0              | BETA-HYDROXY-BETA-METHYL-GLUTARIC-ACID | Petiole    | --      | --       |                      |   |
| 0              | BETA-HYDROXY-BETA-METHYL-GLUTARIC-ACID | Hull Husk  | --      | --       |                      |   |
| 13             | BETA-IONONE                            | Seed       | --      | --       |                      |   |
| 47             | BETA-SITOSTEROL                        | Plant      | --      | --       |                      | Stitt, Paul. Why George should eat broccoli.  |
| 47             | BETA-SITOSTEROL                        | Leaf       | --      | --       |                      |   |
| 47             | BETA-SITOSTEROL                        | Seed       | --      | --       |                      |   |
| 14             | BETAINE                                | Root       | 11.7    | 0.1      | -0.36834838536964337 |   |
| 14             | BETAINE                                | Shoot      | 234     | 2        | -0.576538228658353   |   |
| 4              | BIOTIN                                 | Seed       | 0.132   | 1.4      | -0.5261329414364116  | Jim Duke's personal files.*   |
| 4              | BORON                                  | Seed       | 2       | 7        | -0.8116798946510148  | Betting on Boron, Unpublished draft by J. A. Duke on file at USDA, draft and papers relating to boron percentages. Includes Internat. Z. Vit. Ern. Forschung 43:1973 (boron). |
| 0              | BRASSICASTEROL                         | Seed       | --      | --       |                      | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979.  |

| Activity Count | Chemical               | Plant Part | Low PPM | High PPM | StdDev               | Reference Citation   |
|----------------|------------------------|------------|---------|----------|----------------------|--|
| 0              | BUTENYL-ISOTHIOCYANATE | Seed       | --      | --       |                      |  |
| 102            | CAFFEIC-ACID           | Plant      | --      | --       |                      | Stitt, Paul. Why George should eat broccoli.   |
| 0              | CAFFEIC-ACID-ESTER     | Seed       | --      | --       |                      | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979. |
| 28             | CALCIUM                | Plant      | 3146    | 14300    | 0.07601124250227355  |  |
| 28             | CALCIUM                | Seed       | 400     | 4800     | 0.12003541790252584  |  |
| 0              | CAMPESTANOL            | Leaf       | --      | --       |                      |  |
| 0              | CAMPESTANOL            | Seed       | --      | --       |                      |  |
| 2              | CAMPESTEROL            | Seed       | --      | --       |                      |  |
| 0              | CARBOHYDRATES          | Plant      | 265000  | 861000   | 1.2143728174932495   |  |
| 0              | CARBOHYDRATES          | Seed       | 562000  | 775000   | 0.9999001412733444   |  |
| 0              | CAROTENE               | Plant      | 2.6     | 702      | 0.3623054192861281   | Jim Duke's personal files.*  |
| 0              | CAROTENE               | Seed       | --      | 0.22     | -1                   | Jim Duke's personal files.*  |
| 31             | CARYOPHYLLENE          | Seed       | --      | --       |                      |  |
| 1              | CELLULOSE              | Hull Husk  | 350000  | 350000   | -0.16222142113076254 | ANON. 1948-1976. The Wealth of India raw materials. Publications and Information Directorate, CSIR, New Delhi. 11 volumes. |

| Activity Count | Chemical               | Plant Part | Low PPM | High PPM | StdDev                | Reference Citation                           |
|----------------|------------------------|------------|---------|----------|-----------------------|--|
| 1              | CELLULOSE              | Plant      | 305000  | 305000   | 0.0010903022272763664 | Jim Duke's personal files.*                  |
| 7              | CHLORINE               | Plant      | 1000    | 5700     | -0.16621641797392214  | Jim Duke's personal files.*                  |
| 7              | CHLORINE               | Seed       | 500     | 1900     | 3.160532696671519     | Jim Duke's personal files.*                  |
| 0              | CHLOROPHYLL-A          | Plant      | --      | --       |                       | Stitt, Paul. Why George should eat broccoli. |
| 0              | CHLOROPHYLL-B          | Plant      | --      | --       |                       | Stitt, Paul. Why George should eat broccoli. |
| 0              | CHOLEST-7-EN-3-BETA-OL | Leaf       | --      | --       |                       |  |
| 0              | CHOLEST-7-EN-3-BETA-OL | Seed       | --      | --       |                       |  |
| 0              | CHOLESTANOL            | Leaf       | --      | --       |                       |  |
| 0              | CHOLESTANOL            | Seed       | --      | --       |                       |  |
| 1              | CHOLESTEROL            | Seed       | --      | --       |                       |  |
| 1              | CHOLESTEROL            | Leaf       | --      | --       |                       |  |
| 20             | CHOLINE                | Root       | 24      | 0.2      | -0.4135487761450312   |  |
| 20             | CHOLINE                | Seed       | 134     | 1712     | 0.03730095447113204   |  |
| 20             | CHOLINE                | Shoot      | 37      | 0.3      | -0.7676470168924543   |  |
| 24             | CHROMIUM               | Plant      | 0.9     | 3.9      | -0.4995358912242695   |  |
| 23             | CITRIC-ACID            | Petiole    | --      | --       |                       |  |
| 23             | CITRIC-ACID            | Hull Husk  | --      | --       |                       |  |
| 2              | COBALT                 | Plant      | 0.4     | 1.7      | -0.4218779584044709   |  |

| Activity Count | Chemical                      | Plant Part | Low PPM | High PPM | StdDev               | Reference Citation  |
|----------------|-------------------------------|------------|---------|----------|----------------------|---|
| 2              | COBALT                        | Seed       | --      | 0.32     | -0.19206513214434717 | Jim Duke's personal files.*   |
| 0              | COLAMINE                      | Seed       | --      | --       |                      | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979.                          |
| 12             | COPPER                        | Plant      | 4       | 4        | -1.1092588472799756  | Jim Duke's personal files.*   |
| 12             | COPPER                        | Seed       | 2.4     | 25.7     | 0.987370350962101    | Jim Duke's personal files.*   |
| 2              | CYSTINE                       | Seed       | 1000    | 5000     | 1.2870395709433473   | Jim Duke's personal files.*   |
| 5              | DAUCOSTEROL                   | Seed       | --      | --       |                      |   |
| 0              | DEC-TRANS-2-EN-1-AL           | Seed       | --      | --       |                      |   |
| 0              | DEC-TRANS-2-TRANS-4-DIEN-1-AL | Seed       | --      | --       |                      |   |
| 1              | DELTA-5-AVENASTEROL           | Seed       | --      | --       |                      |   |
| 1              | DELTA-7-AVENASTEROL           | Seed       | --      | --       |                      | Rizk, A.F.M., The Phytochemistry of the Flora of Qatar, Scientific and Applied Research Centre, University of Qatar, Kingprint, Richmond, UK, 1986. |
| 0              | DELTA-7-STIGMASTEROL          | Seed       | --      | --       |                      | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979.                          |

| Activity Count | Chemical                         | Plant Part      | Low PPM | High PPM | StdDev              | Reference Citation   |
|----------------|----------------------------------|-----------------|---------|----------|---------------------|--|
| 0              | DELTA-AMINO-LEVULINIC-ACID       | Sprout Seedling | --      | --       |                     |  |
| 0              | DIADENOSINE-TETRAPHOSPHORIC-ACID | Sprout Seedling | --      | --       |                     | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979. |
| 0              | DIAMINO-PROPANE                  | Sprout Seedling | --      | --       |                     |  |
| 0              | DIHYDROHAEMATINIC-ACID           | Hull Husk       | --      | --       |                     |  |
| 0              | DIMETHOXY-BUTYL-BENZENE          | Petiole         | --      | --       |                     |  |
| 0              | DIMETHOXY-BUTYL-BENZENE          | Hull Husk       | --      | --       |                     |  |
| 0              | ERGOTHIONEINE                    | Seed            | --      | --       |                     |  |
| 0              | FAT                              | Plant           | 1540    | 7000     | -0.6531012955597851 |  |
| 0              | FAT                              | Seed            | 11000   | 97000    | -0.8869576751709459 |  |
| 61             | FERULIC-ACID                     | Seed            | --      | --       |                     |  |
| 0              | FERULIC-ACID-ESTER               | Seed            | --      | --       |                     | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979. |
| 15             | FIBER                            | Plant           | 122000  | 417000   | 1.43574425001656    | Jim Duke's personal files.*  |
| 15             | FIBER                            | Seed            | 10000   | 289000   | 1.2177567557101374  |  |
| 0              | FIBER(CRUDE)                     | Plant           | --      | 173000   | 1.2755446864775144  |  |

| Activity Count | Chemical         | Plant Part | Low PPM | High PPM | StdDev               | Reference Citation   |
|----------------|------------------|------------|---------|----------|----------------------|--|
| 0              | FIBER(DIETARY)   | Plant      | --      | 620000   | 2.767466493208292    |  |
| 15             | FOLACIN          | Seed       | --      | 0.75     | -0.7652388262743898  |  |
| 23             | FOLIC-ACID       | Seed       | --      | 0.75     | -0.35541240931301027 | Jim Duke's personal files.*  |
| 12             | FORMALDEHYDE     | Seed       | --      | --       |                      |  |
| 8              | FRUCTOSE         | Plant      | --      | --       |                      | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979. |
| 8              | FRUCTOSE         | Root       | --      | --       |                      |  |
| 0              | FUR-2-ALDEHYDE   | Seed       | --      | --       |                      |  |
| 6              | FURFURAL         | Hull Husk  | 100000  | 132000   |                      |  |
| 0              | GAMMA-MUUROLENE  | Seed       | --      | --       |                      |  |
| 0              | GERANIOL-ACETONE | Seed       | --      | --       |                      |  |
| 7              | GLUCOSE          | Plant      | --      | --       |                      | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979. |
| 0              | GLUCOVANILLIN    | Hull Husk  | --      | --       |                      | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979. |
| 8              | GLUTAMIC-ACID    | Plant      | 19000   | 19000    | -0.17653409934818678 | Jim Duke's personal files.*  |

| Activity Count | Chemical                 | Plant Part | Low PPM | High PPM | StdDev              | Reference Citation   |
|----------------|--------------------------|------------|---------|----------|---------------------|--|
| 8              | GLUTAMIC-ACID            | Seed       | 29000   | 31000    | -0.4519999471714031 | Jim Duke's personal files.*  |
| 0              | GLUTARIC-ACID            | Petiole    | --      | --       |                     |  |
| 0              | GLUTARIC-ACID            | Hull Husk  | --      | --       |                     |  |
| 2              | GLUTEN                   | Seed       | --      | --       |                     | Jeffery B. Harborne and H. Baxter, eds. 1983. Phytochemical Dictionary. A Handbook of Bioactive Compounds from Plants. Taylor & Frost, London. 791 pp. |
| 12             | GLYCINE                  | Seed       | 2000    | 2000     | -1.294330495155266  | Jim Duke's personal files.*  |
| 0              | GRAMININE                | Rhizome    | --      | --       |                     | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979.                             |
| 1              | GUANINE                  | Plant      | --      | --       |                     | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979.                             |
| 0              | HEPTAN-1-AL              | Seed       | --      | --       |                     |  |
| 0              | HEPTANAL                 | Seed       | --      | --       |                     |  |
| 0              | HEX-CIS-3-EN-1-OL        | Seed       | --      | --       |                     |  |
| 0              | HEX-TRANS-3-ENYL-ACETATE | Seed       | --      | --       |                     |  |
| 0              | HEXAN-1-AL               | Seed       | --      | --       |                     |  |

| Activity Count | Chemical                             | Plant Part | Low PPM | High PPM | StdDev               | Reference Citation   |
|----------------|--------------------------------------|------------|---------|----------|----------------------|--|
| 5              | HEXANAL                              | Seed       | --      | --       |                      |  |
| 1              | HEXYL-ACETATE                        | Seed       | --      | --       |                      |  |
| 7              | HISTIDINE                            | Seed       | 1000    | 6000     | -0.03298707830764554 | Jim Duke's personal files.*  |
| 8              | HORDENINE                            | Leaf       | --      | --       |                      | Wealth of India.   |
| 0              | HYPOXANTHIN                          | Plant      | --      | --       |                      | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979. |
| 0              | INDOLE-3-ACETIC-ACID-GLUCOPROTEIN    | Shoot      | --      | --       |                      |  |
| 0              | INDOLE-3-ACETIC-ACID-GLUCOPROTEIN    | Seed       | --      | --       |                      |  |
| 12             | IODINE                               | Plant      | 0.154   | 0.154    | -0.4470535169676872  | Jim Duke's personal files.*  |
| 6              | IRON                                 | Plant      | 3       | 13.5     | -0.7224047313177726  |  |
| 6              | IRON                                 | Seed       | 20      | 300      | 0.6932609533256522   | Jim Duke's personal files.*  |
| 3              | ISOLEUCINE                           | Plant      | 13000   | 13000    | 0.629975306413423    | Jim Duke's personal files.*  |
| 3              | ISOLEUCINE                           | Seed       | 4000    | 9000     | -0.1903246733732836  | Jim Duke's personal files.*  |
| 4              | ISOORIENTIN                          | Leaf       | --      | --       |                      |  |
| 0              | ISOORIENTIN-2'-O-ALPHA-L-ARABINOSIDE | Leaf       | --      | --       |                      |  |
| 0              | ISOORIENTIN-2'-O-ARABINOSIDE         | Leaf       | --      | --       |                      |  |
| 0              | ISOORIENTIN-2'-O-BETA-D-DIGLYCOSIDE  | Leaf       | --      | --       |                      |  |
| 0              | ISOORIENTIN-7-O-BETA-D-GLYCOSIDE     | Leaf       | --      | --       |                      |  |

| Activity Count | Chemical                             | Plant Part      | Low PPM | High PPM | StdDev               | Reference Citation  |
|----------------|--------------------------------------|-----------------|---------|----------|----------------------|---|
| 0              | ISOPROPYL-TARTARIC-ACID              | Hull Husk       | --      | --       |                      |   |
| 0              | ISOSWERTISIN-2'-O-ALPHA-L-RHAMNOSIDE | Leaf            | --      | --       |                      |   |
| 0              | ISOSWERTISIN-2'-O-ALPHA-L-RHAMNOSIDE | Shoot           | --      | --       |                      |   |
| 0              | ISOSWERTISIN-2'-RHAMNOSIDE           | Leaf            | --      | 16       |                      |   |
| 0              | ISOSWERTISIN-O'-RHAMNOSIDE           | Leaf            | 16      | 16       |                      |   |
| 4              | ISOVITEXIN                           | Plant           | --      | --       |                      | Stitt, Paul. Why George should eat broccoli.                              |
| 4              | ISOVITEXIN                           | Sprout Seedling | --      | --       |                      |   |
| 0              | ISOVITEXIN--O-ARABINOSIDE            | Sprout Seedling | --      | --       |                      |   |
| 0              | ISOVITEXIN-2'-O-ALPHA-L-ARABINOSIDE  | Shoot           | --      | --       |                      |   |
| 0              | ISOVITEXIN-2'-O-ARABINOSIDE          | Leaf            | --      | --       |                      |   |
| 0              | ISOVITEXIN-2'-O-RHAMNOSIDE           | Stem            | --      | --       |                      |   |
| 0              | KILOCALORIES                         | Plant           | 4529    | 4540     | 1.1415923130022652   |   |
| 0              | KILOCALORIES                         | Seed            | 3740    | 4710     | -0.11644557042776867 | CRC Handbook of Medicinal Herbs and/or CRC Handbook of Proximate Analyses |
| 2              | LEUCINE                              | Plant           | 18000   | 18000    | 0.4870195094224758   | Jim Duke's personal files.*   |
| 2              | LEUCINE                              | Seed            | 6000    | 14000    | -0.2949527778801378  | Jim Duke's personal files.*   |
| 0              | LICHENIN                             | Seed            | --      | --       |                      |   |

| Activity Count | Chemical                            | Plant Part | Low PPM | High PPM | StdDev                | Reference Citation   |
|----------------|-------------------------------------|------------|---------|----------|-----------------------|--|
| 13             | LIGNIN                              | Hull Husk  | 100000  | 150000   | -1                    | ANON. 1948-1976. The Wealth of India raw materials. Publications and Information Directorate, CSIR, New Delhi. 11 volumes. |
| 13             | LIGNIN                              | Plant      | 85000   | 85000    | -0.9668714696835661   | Jim Duke's personal files.*  |
| 60             | LIMONENE                            | Seed       | --      | --       |                       |  |
| 0              | LOPHENOL                            | Seed       | --      | --       |                       |  |
| 0              | LOPHENOL                            | Leaf       | --      | --       |                       |  |
| 0              | LUTEOLIN-6-C-GLUCOSIDE              | Leaf       | --      | --       |                       |  |
| 0              | LUTEOLIN-6-C-GLUCOSYL-ARABINOSIDE   | Leaf       | --      | --       |                       |  |
| 0              | LUTEOLIN-6-C-GLUCOSYL-O-ARABINOSIDE | Leaf       | --      | --       |                       |  |
| 4              | LYSINE                              | Plant      | 14000   | 14000    | 0.48205927294439394   | Jim Duke's personal files.*  |
| 4              | LYSINE                              | Seed       | 2000    | 7000     | -0.6906340633332377   | Jim Duke's personal files.*  |
| 65             | MAGNESIUM                           | Plant      | 2640    | 12000    | 2.4628926226809362    |  |
| 65             | MAGNESIUM                           | Seed       | 300     | 2900     | -0.018215347061146407 | Jim Duke's personal files.*  |
| 15             | MALIC-ACID                          | Petiole    | --      | --       |                       |  |
| 15             | MALIC-ACID                          | Hull Husk  | --      | --       |                       |  |
| 1              | MALONIC-ACID                        | Petiole    | --      | --       |                       |  |
| 1              | MALONIC-ACID                        | Hull Husk  | --      | --       |                       |  |

| Activity Count | Chemical                    | Plant Part      | Low PPM | High PPM | StdDev                | Reference Citation   |
|----------------|-----------------------------|-----------------|---------|----------|-----------------------|--|
| 14             | MANGANESE                   | Plant           | 0.1     | 0.5      | -0.6913213438464151   |  |
| 14             | MANGANESE                   | Seed            | 20      | 204      | 1.8744753503352685    | Jim Duke's personal files.*  |
| 23             | MELATONIN                   | Seed            | --      | --       |                       | Hattori, A., et. al. 1995. Identification of Melatonin in Plants and its Effects on Plasma Melatonin Levels and Binding to Melatonin Receptors in Vertebrates. Biochem. Mol. Biol. Int., 35(3): 627-634. |
| 15             | METHIONINE                  | Plant           | 2000    | 2000     | 0.009670052634868679  | Jim Duke's personal files.*  |
| 15             | METHIONINE                  | Seed            | 1000    | 4000     | -0.0812868777702854   | Jim Duke's personal files.*  |
| 0              | METHOXY-MALIC-ACID          | Petiole         | --      | --       |                       |  |
| 0              | METHOXY-MALIC-ACID          | Hull Husk       | --      | --       |                       |  |
| 0              | MYOINOSITOL-OXIDASE         | Shoot           | --      | --       |                       | Wealth of India.   |
| 22             | MYRCENE                     | Seed            | --      | --       |                       |  |
| 39             | NIACIN                      | Plant           | 17      | 75       | -0.024042680398474098 |  |
| 39             | NIACIN                      | Seed            | 6       | 44       | 0.03334512236633281   | Jim Duke's personal files.*  |
| 1              | NICOTIANAMINE               | Sprout Seedling | --      | --       |                       |  |
| 0              | NONA-TRANS-2-TRANS-4-DIENAL | Seed            | --      | --       |                       |  |
| 0              | NONAN-1-AL                  | Seed            | --      | --       |                       |  |
| 0              | NONAN-1-OL                  | Seed            | --      | --       |                       |  |

| Activity Count | Chemical                                   | Plant Part      | Low PPM | High PPM | StdDev              | Reference Citation   |
|----------------|--|-----------------|---------|----------|---------------------|--|
| 0              | NUATIGENIN                                 | Seed            | --      | --       |                     | Jeffery B. Harborne and H. Baxter, eds. 1983. Phytochemical Dictionary. A Handbook of Bioactive Compounds from Plants. Taylor & Frost, London. 791 pp. |
| 0              | O'-RHAMNOSYL-8-C-D-GLUCOPYRANOSYLGENKWANIN | Sprout Seedling | --      | --       |                     | Rizk, A.F.M., The Phytochemistry of the Flora of Qatar, Scientific and Applied Research Centre, University of Qatar, Kingprint, Richmond, UK, 1986.    |
| 0              | OCT-1-EN-3-OL                              | Seed            | --      | --       |                     |  |
| 0              | OCT-TRANS-2-EN-1-OL                        | Seed            | --      | --       |                     |  |
| 0              | OCTAN-1-AL                                 | Seed            | --      | --       |                     |  |
| 0              | OCTAN-1-OL                                 | Seed            | --      | --       |                     |  |
| 0              | OCTANAL                                    | Seed            | --      | --       |                     |  |
| 0              | ORGOTHIONENINE                             | Seed            | --      | --       |                     | Wealth of India.   |
| 9              | OXALIC-ACID                                | Plant           | 400     | 400      | -0.5323291024119612 | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979.                             |
| 25             | P-COUMARIC-ACID                            | Seed            | --      | --       |                     |  |
| 13             | P-HYDROXY-BENZOIC-ACID                     | Seed            | --      | --       |                     |  |

| Activity Count | Chemical                         | Plant Part      | Low PPM | High PPM | StdDev               | Reference Citation   |
|----------------|----------------------------------|-----------------|---------|----------|----------------------|--|
| 11             | PANTOTHENIC-ACID                 | Plant           | 3.5     | 45.3     | 0.9128756483055993   | Jim Duke's personal files.*  |
| 11             | PANTOTHENIC-ACID                 | Seed            | 4.4     | 28.3     | 1.2104233244034384   | Jim Duke's personal files.*  |
| 24             | PECTIN                           | Plant           | --      | 800      | -0.774079561685048   | Wealth of India.   |
| 0              | PENTANE-1,3,4-TRICARBOXYLIC-ACID | Hull Husk       | --      | --       |                      |  |
| 0              | PENTOSANS                        | Hull Husk       | 320000  | 360000   | 1                    | ANON. 1948-1976. The Wealth of India raw materials. Publications and Information Directorate, CSIR, New Delhi. 11 volumes.   |
| 0              | PHAEOPHORBIDE                    | Sprout Seedling | --      | --       |                      |  |
| 7              | PHENYLALANINE                    | Seed            | 4000    | 10000    | -0.1839547111693311  | Jim Duke's personal files.*  |
| 4              | PHOSPHORUS                       | Plant           | 618     | 2810     | -0.3741734298409137  |  |
| 4              | PHOSPHORUS                       | Seed            | 500     | 10200    | 1.2807700551263885   | Jim Duke's personal files.*  |
| 5              | PHYLLOQUINONE                    | Seed            | --      | 0.1      | -0.04540766091865027 |  |
| 0              | PHYTATE                          | Seed            | 8970    | 10000    | -0.30876780753705974 |  |
| 9              | PHYTIC-ACID                      | Hull Husk       | 5600    | 8700     |                      |  |
| 9              | PHYTIC-ACID                      | Bran            | --      | --       |                      |  |
| 2              | PHYTOSTEROLS                     | Seed            | --      | 580      | -0.49166318384124835 | Spiller, G. A. 1996 (Spiller, G. A. Ed. 1996. CRC Handbook of Lipids in Human Nutrition. CRC Press. Boca Raton, FL. 233 pp.) |

| Activity Count | Chemical                    | Plant Part | Low PPM | High PPM | StdDev               | Reference Citation   |
|----------------|-----------------------------|------------|---------|----------|----------------------|--|
| 14             | POTASSIUM                   | Plant      | 598     | 2720     | -1.3304292991673436  |  |
| 14             | POTASSIUM                   | Seed       | 2200    | 8900     | -0.3227574844725049  | Jim Duke's personal files.*  |
| 0              | PROLINE                     | Root       | 276     | 2.4      | -1.2997594393680416  |  |
| 0              | PROLINE                     | Shoot      | 150     | 1.3      | -0.7081532669989642  |  |
| 0              | PROPANAL                    | Seed       | --      | --       |                      |  |
| 0              | PROTEIN                     | Plant      | 15840   | 72000    | -0.8315036968096554  |  |
| 0              | PROTEIN                     | Seed       | 74000   | 232000   | -0.01597695077093895 | Jim Duke's personal files.*  |
| 0              | PUTRESCINE                  | Leaf       | --      | 1186     |                      |  |
| 43             | PYRIDOXINE                  | Plant      | 1.76    | 3.08     |                      | Jim Duke's personal files.*  |
| 43             | PYRIDOXINE                  | Seed       | 0.22    | 2.4      | -0.8240428163590194  | Jim Duke's personal files.*  |
| 176            | QUERCETIN                   | Hay        | 310     | 310      |                      |  |
| 15             | RIBOFLAVIN                  | Plant      | 0.4     | 2        | -0.6558678757056521  |  |
| 15             | RIBOFLAVIN                  | Seed       | 0.66    | 11.66    | 3.1334031477822193   | Jim Duke's personal files.*  |
| 7              | SALICYLATES                 | Seed       | --      | --       | -0.3401776874861938  |  |
| 0              | SALICYLIC-ACID-METHYL-ESTER | Seed       | --      | --       |                      |  |
| 5              | SAPONINS                    | Seed       | 1000    | 13000    | -0.3206748989657371  | Spiller, G. A. 1996 (Spiller, G. A. Ed. 1996. CRC Handbook of Lipids in Human Nutrition. CRC Press. Boca Raton, FL. 233 pp.) |
| 44             | SCOPOLETIN                  | Root       | 10      | 10       | -1                   |  |

| Activity Count | Chemical      | Plant Part      | Low PPM | High PPM | StdDev               | Reference Citation   |
|----------------|---------------|-----------------|---------|----------|----------------------|--|
| 44             | SCOPOLETIN    | Sprout Seedling | --      | --       |                      |  |
| 3              | SCOPOLIN      | Sprout Seedling | --      | --       |                      |  |
| 0              | SECALOSE      | Plant           | --      | --       |                      | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979. |
| 60             | SELENIUM      | Plant           | 0.3     | 1.3      | -0.3695058107533004  |  |
| 60             | SELENIUM      | Bran            | --      | --       |                      |  |
| 1              | SERINE        | Seed            | 4000    | 4000     | -1.2599694074180983  | Jim Duke's personal files.*  |
| 0              | SILICA        | Plant           | --      | 36000    | -0.6150458899014142  | Wealth of India.   |
| 1              | SILICIC-ACID  | Leaf            | --      | --       |                      | Wealth of India.   |
| 4              | SILICON       | Plant           | 4       | 18.3     | -0.4358023545388019  |  |
| 0              | SILICON-OXIDE | Ash             | --      | --       |                      |  |
| 0              | SILICON-OXIDE | Plant           | --      | --       |                      |  |
| 9              | SINAPIC-ACID  | Seed            | --      | --       |                      |  |
| 1              | SODIUM        | Plant           | 862     | 3920     | -0.08708138356494911 |  |
| 1              | SODIUM        | Seed            | 100     | 1600     | 1.824152591251745    | Jim Duke's personal files.*  |
| 1              | SPERMIDINE    | Leaf            | 14      | 14       |                      |  |
| 1              | SPERMINE      | Leaf            | 13      | 13       |                      |  |

| Activity Count | Chemical                          | Plant Part | Low PPM | High PPM | StdDev             | Reference Citation   |
|----------------|-----------------------------------|------------|---------|----------|--------------------|--|
| 5              | STARCH                            | Seed       | 500000  | 600000   | 1.1736828138582762 | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979. |
| 0              | STIGMAST-7-EN-3-BETA-OL           | Leaf       | --      | --       |                    |  |
| 0              | STIGMAST-7-EN-3-BETA-OL           | Seed       | --      | --       |                    |  |
| 0              | STIGMASTA-7,24(28)-DIEN-3-BETA-OL | Seed       | --      | --       |                    |  |
| 0              | STIGMASTADIENOL                   | Seed       | --      | --       |                    | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979. |
| 0              | STIGMASTANEDIOL                   | Seed       | --      | --       |                    |  |
| 0              | STIGMASTANOL                      | Leaf       | --      | --       |                    |  |
| 0              | STIGMASTANOL                      | Seed       | --      | --       |                    |  |
| 12             | STIGMASTEROL                      | Seed       | --      | --       |                    |  |
| 12             | STIGMASTEROL                      | Leaf       | --      | --       |                    |  |
| 14             | SUCROSE                           | Plant      | --      | --       |                    | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979. |

| Activity Count | Chemical           | Plant Part | Low PPM | High PPM | StdDev               | Reference Citation   |
|----------------|--------------------|------------|---------|----------|----------------------|--|
| 0              | SUGARS             | Plant      | 30000   | 93000    | -0.22286679279323657 | ANON. 1948-1976. The Wealth of India raw materials. Publications and Information Directorate, CSIR, New Delhi. 11 volumes. |
| 0              | SUGARS             | Seed       | 20000   | 50000    | -0.14394703178324852 | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979. |
| 14             | SULFUR             | Plant      | 800     | 4100     | 0.1026280463781624   | Jim Duke's personal files.*  |
| 14             | SULFUR             | Seed       | 1500    | 3100     | 0.31967317026072223  | Jim Duke's personal files.*  |
| 6              | TARTARIC-ACID      | Petiole    | --      | --       |                      |  |
| 6              | TARTARIC-ACID      | Hull Husk  | --      | --       |                      |  |
| 31             | THIAMIN            | Plant      | 0.9     | 4        | -0.3059929673424499  | Jim Duke's personal files.*  |
| 31             | THIAMIN            | Seed       | 2.6     | 12.1     | 1.3159899428962132   |  |
| 0              | THIAMINE           | Plant      | 0.4     | 2        | -0.4618949437111338  |  |
| 4              | THREONINE          | Plant      | 16000   | 16000    | 1.1658056814606805   | Jim Duke's personal files.*  |
| 4              | THREONINE          | Seed       | 3000    | 7000     | -0.2544416663340577  | Jim Duke's personal files.*  |
| 4              | TIN                | Plant      | 1.3     | 6        | -1.008758312691185   |  |
| 0              | TRANS-BETA-OCIMENE | Seed       | --      | --       |                      |  |
| 0              | TRANS-HEPT-2-ENAL  | Seed       | --      | --       |                      |  |

| Activity Count | Chemical                              | Plant Part    | Low PPM | High PPM | StdDev               | Reference Citation          |
|----------------|---------------------------------------|---------------|---------|----------|----------------------|-----------------------------|
| 0              | TRANS-NON-2-EN-1-AL                   | Seed          | --      | --       |                      |                             |
| 0              | TRANS-NON-2-ENAL                      | Seed          | --      | --       |                      |                             |
| 9              | TRICIN                                | Leaf          | --      | --       |                      |                             |
| 0              | TRICIN-4',7-DI-O-BETA-D-GLYCOSIDE     | Inflorescence | --      | --       |                      |                             |
| 0              | TRICIN-4'-O-ALPHA-L-ARABINOSIDE       | Inflorescence | --      | --       |                      |                             |
| 0              | TRICIN-4'-O-ALPHA-L-ARABINOSIDE       | Leaf          | --      | --       |                      |                             |
| 0              | TRICIN-4'-O-BETA-D-GLUCOSIDE          | Leaf          | --      | --       |                      |                             |
| 0              | TRICIN-4'-O-BETA-D-GLYCOSIDE          | Leaf          | --      | --       |                      |                             |
| 0              | TRICIN-7-O-ALPHA-L-RHAMNOSYL-HEXOSIDE | Stem          | --      | --       |                      |                             |
| 0              | TRICIN-7-O-BETA-D-GLUCOSIDE           | Leaf          | --      | --       |                      |                             |
| 0              | TRICIN-7-O-BETA-D-GLYCOSIDE           | Leaf          | --      | --       |                      |                             |
| 15             | TRIGONELLINE                          | Seed          | --      | --       |                      | Wealth of India.            |
| 29             | TRYPTOPHAN                            | Plant         | 2000    | 2000     | -0.9503762425454777  | Jim Duke's personal files.* |
| 29             | TRYPTOPHAN                            | Seed          | --      | 3000     | -0.1108675145369685  | Jim Duke's personal files.* |
| 8              | TYROSINE                              | Seed          | 2000    | 14000    | 1.4498681987287636   | Jim Duke's personal files.* |
| 0              | URONIC-ACIDS                          | Plant         | --      | --       |                      |                             |
| 3              | VALINE                                | Plant         | 12000   | 12000    | 0.45057332688469326  | Jim Duke's personal files.* |
| 3              | VALINE                                | Seed          | 4000    | 11000    | -0.12458055729354042 | Jim Duke's personal files.* |
| 24             | VANILLIC-ACID                         | Seed          | --      | --       |                      |                             |

| Activity Count | Chemical                         | Plant Part      | Low PPM | High PPM | StdDev               | Reference Citation   |
|----------------|----------------------------------|-----------------|---------|----------|----------------------|--|
| 28             | VANILLIN                         | Plant           | --      | --       |                      | Stitt, Paul. Why George should eat broccoli.   |
| 0              | VITAMIN-A                        | Leaf            | --      | 0.6      |                      |  |
| 24             | VITAMIN-B-1                      | Seed            | --      | 7        | 1.0000000000000002   |  |
| 0              | VITAMIN-B-2                      | Seed            | --      | 1.3      | 1                    |  |
| 1              | VITEXIN-2''-O-ALPHA-L-RHAMNOSIDE | Shoot           | --      | --       |                      |  |
| 0              | VITEXIN-2'-RHAMNOSIDE            | Leaf            | --      | --       |                      | J.S. Glasby Dict.Pls Containing 2ndary Metabolite. 1991.   |
| 0              | VITEXIN-O-GLUCOSIDE              | Sprout Seedling | --      | --       |                      |  |
| 0              | WATER                            | Plant           | --      | 780000   | 0.038825343690180966 |  |
| 0              | WATER                            | Seed            | 48000   | 213000   | -0.05605353286919712 | Jim Duke's personal files.*  |
| 0              | WAX                              | Seed            | 9000    | 9000     | -0.0905357460425187  |  |
| 0              | XANTHOPHYLL-EPOXIDE              | Sprout Seedling | --      | --       |                      | List, P.H. and Horhammer, L., Hager's Handbuch der Pharmazeutischen Praxis, Vols. 2-6, Springer-Verlag, Berlin, 1969-1979. |
| 77             | ZINC                             | Plant           | --      | --       |                      |  |